bristly hairs. The bristles on hind part of head black. *Thorax* dark, covered with grey tomentum, with two very distinct, narrow, blackish-brown, median stripes and duller greenish spots at sides; præsutural bristles two in number; the supra-alar and postalar respectively three in number, all black and very stout; median posterior bristles also stout and numerous. *Scutellum* same colour as thorax, with two black bristles. *Abdomen* brownish black, covered with greenish-grey tomentum, very noticeable yellow bristles at sides of each segment, and the dorsum covered with short black pubescence; a stouter row of black bristly hairs on the posterior borders of segments, which also appear paler in colour; genitalia small, black and shining, with black pubescence. *Legs* reddish yellow, with a black stripe on all the femora and the two posterior pairs with black hairs; the posterior tibiæ darker at apices and the tarsi all darker at the joints; all bristles black with the exception of two or three long yellowish bristles on the fore and middle tibiæ at apices and at the bases of the first tarsal joints; pubescence short, black, some longer white pubescence on the underside of the fore femora and some short yellow pubescence on the outer edges of the tibiæ and first tarsal joints. *Wings* clear, grey at apex and on hind border, the posterior fork of the third vein slightly curved, the small transverse vein beyond the middle of the discal cell.

Female identical, the yellow bristles on the legs not always present; ovipositor, which does not include the seventh segment, is about the length of the last two segments together.

VII.—Batopora (*Bryozoa*) *and its Allies.*

By Arthur Wm. Waters, F.L.S., F.G.S.

[Plate VI.]

Contents.

As several interesting points have turned up relating to *Batopora* and its allies, it seems better to publish an account at once, without waiting for the publication of a paper,

now ready, dealing with species growing in a cupuliform shape, including Selenariadæ and Conescharellinidæ, as the consequences of war may cause delay.

The re-examination of some specimens of what Haswell described as *Sphærophora fossa* show the importance of this species in throwing light on certain fossils. The zoaria are small, and were described as subspherical "with a circular pit at the upper pole," but it does not seem that we must speak of the pit being at the upper pole. The growth is towards the pit, a fact correctly shown by Haswell, although he does not allude to it (Pl. VI. fig. 1). Another form with zoaria about the same size, described by Reuss* as *Diplotaxis placentula*, now changed by Gregory † to *Biselenaria*, as the name *Diplotaxis* was preoccupied, grows on one surface to the border and then turns over to the other growing towards the centre. Although the growth in the two forms considered is not quite identical, they partially explain one another. Canu ‡ in describing *Biselenaria affa*, Greg., says the zoœcia radiate from a "grande ancestrule," which, however, is not shown in Canu's figure, and, as the zoœcia are Membraniporidan, it is difficult to understand.

The importance of the pit was appreciated by Haswell, who did not attempt any explanation in his first paper, but in a subsequent one § he mentions a *Cellepora* with minute Actinids lodged in cylindrical pits, excavated in the substance of the polyzoarium. He thinks this may throw some light on the pits of *Sphærophora fossa*, and described it as a case of symbiosis of Actinid with *Cellepora*. However, as regards *S. fossa*, the definite position of this pit in recent species from various localities, as well as in fossils from many localities, makes this very improbable; nor is this all, for it is clear that what was described as "aufrecht stehende Zelle" or "primoidial Zelle" by Reuss and others in *Batopora* and some allied genera is a similar pit, though much smaller. In both cases there is a raised ridge surrounding the border (Pl. VI. fig. 6), and there are in the pits large pores leading to the surrounding zoœcia. Reuss, who had seen the tubes from these pores, spoke of them as a hydrostatic system, but how he considered that the system functioned is not clear. Canu ‖ and Bassler also refer to a hydrostatic system.

* Bry. des deutsch. Unterolig. Sitz. d. k. Akad. Wissen. Wien, lv. p. 231, pl. ii. figs. 5-7 (1864).

† "Brit. Pal. Bry.," Trans. Zool. Soc. London, vol. xiii. p. 234 (1895).

‡ "Bry. Tert.," Ann. de Paléon. vol. ii. p. 30 (1907).

§ Proc. Linn. Soc. N.S. Wales, vol. vii. p. 608 (1882).

‖ Early Tert. Cheil. Bry. p. 73; Smithsonian Inst. U.S. Nat. Mus. Bull. 96 (1917).

The pit in the common *Batopora multiradiata* is found to continue through the two layers, for the mature zoarium consists of two or more layers, as described by Reuss and as figured by me * (see also Pl. VI. fig. 4). As the mature *multiradiata* is two-layered, we should be able to find an earlier stage, and to do so I again searched through material from different places where it occurs, and in most cases found a small globular *Batopora*, which is what I determined as *B. stoliczkai*, Rss., though what were taken to be appendages are probably young zoœcia in course of formation and are not always found, and then there seems to be no material difference from *B. rosula*, Rss., so that perhaps *rosula* and *stoliczkai* are synonyms. The possibility of a globular *Batopora* being the first stage was foreseen by Reuss and also by me, but at that time was rejected.

The primary is well within this globular form. I have found a very similar pit in *Orbitulipora lenticularis*, Rss., from Montecchio Maggiore, but in a very different position—namely, near the periphery directed towards the middle of the zoarium, and in *Orbitulipora petiolus* one has been figured by Dixon † and by Gregory ‡ at the side. On p. 92 it is seen to be continuous from the centre to the circumference of the zoarium. MacGillivray § and Maplestone ‖ speak of there sometimes being more than one pit in *S. fossa*, but I have seen nothing of the kind. Perhaps they had found a true *Cellepora*. Is there any other explanation of these pits, except the perforating Actinid? The large pores in the pits, with their tube or chamber leading to the zoœcia (Pl. VI. figs. 3, 4), is undoubtedly a point of much importance, and the explanation now offered is that these pores indicate the attachment of radicles, which together form a solid bundle such as we know in various Bryozoa ¶.

The shape of the oral aperture (0·12 mm.) and of the

* North Ital. Bryozoa, p. 33, figure in text; Quart. Journ. Geol. Soc. vol. xlvii. (1891).

† Geol. & Fossils of Tert. & Cret. Form. of Sussex, p. 151, pl. i. fig. 10 (1850).

‡ Brit. Pal. Bry. pl. xxxi. figs. 12, 13.

§ "Tert. Poly. of Vict.," Trans. R. Soc. Vict. p. 108 (1895).

‖ "New or little-known Polyzoa," Proc. R. S. Vict. vol. xxv. p. 361 (1913).

¶ Preparations had been made, and the drawings for Plates completed, before I had an idea of any theories of Canu and Bassler. In a short letter from Canu, he seems to have come to the conclusion that *Conescharellina* and some other genera lived with the apex of the cone below, and were attached, as partly suggested by d'Orbigny. I see that there will be points of agreement between us, but I am awaiting their complete work.

zoœcia, as well as the ovicell would, if considered alone, place *Sphærophora fossa* with *Holoporella*, a genus which I separated from *Cellepora*.

A specimen of *Stichoporina reussi*, Stol., from Latdorf, given to me by Dr. Pergens, has a pit as described, and the zoœcial opening as first seen is round or slightly oval, but on looking down the peristome the lower edge of the oral aperture is found to be nearly straight (0·08 mm.) and this is also the case in *Batopora* (text-fig. 1, *f*, *g*).

Although there are these similarities between *S. reussi* and *Batopora multiradiata*, the underside of *S. reussi* shows the zoœcial shape and is not filled in, also the early growth must have been different. In my specimen of *reussi* the zoœcia near the pit are raised, whether because they are larger or because a second layer is commencing cannot be decided from the specimen—at any rate, the inner raised zoœcia are directed towards the pit, while the outer ones are directed away from it. Canu * has united *S. reussi* and *Batopora multiradiata* as one species, which does not seem to be the case, nor will they probably remain in the same genus. Canu says "unilamellaire," but *B. multiradiata* is bilamellar. This examination shows that Koschinsky was not right in uniting his species of *Stichoporina* with Stoliczka's, for none of Koschinsky's have a pit, besides which, the oral aperture of Koschinsky's species is much larger with a distinct contraction at each side, so that *S. simplex*, *S. protecta*, *S. crassilabris*, and *S. bidentata*, Rss., must be placed elsewhere, and they seem to agree with *Mamillopora*, Smitt.

Neviani † published a paper on *Stichoporina*, though now most species referred to seem to belong to the genus *Mamillopora*. The reason for separating them from *Stichoporina* has been given, and in none other that Neviani mentions is there a pit. *Fedora edwardsi*, Jull., is a hollow cylinder, as are also *Kionidella* (*Discoflustrellaria*) *dactylus*, d'Orb., and *F. excelsa*, Kosch., though with a small lumen, and both seem to belong to *Mamillopora*.

Canu ‡, speaking of *Stichoporina reussi*, Stol., says "ancestrule membraniporoide," but are we yet correctly acquainted with the ancestrule?

The genus *Prattia*, d'Archiac, I should place under *Mamillopora*, though Canu § has left it as *Prattia*, and

* Bry. Tert. p. 100.

† "Nuova sp. foss. di *Stichoporina*," Bull. Soc. Rom. per gli Stud. Zool. vol. iv. p. 1 (1895).

‡ Bry. Tert. p. 100, pl. xi. figs. 16–18 (1907).

§ "Bry. du Sud-Ouest de la France," Bull. Soc. Géol. de France, ser. 4, vol. x. p. 854 (1910).

Faura and Canu* have done the same. Canu has refigured d'Archiac's specimens, and it will be seen that the zoœcia differ but very slightly from *Mamillopora* (*Stichoporina*) *simplex*, Kosch., although the avicularium is much larger, also the *Fedora glandulosa*, d'Arch., as figured by Canu, looks much like *Mamillopora crassilabris*, Kosch., and I should place it under *Mamillopora*.

Mamillopora (*Ascosia*) *pandora*†, Jullien, belongs to this genus or to the family. The barrel-shaped zoœcia are erect, and, as seen in a specimen given to me by Jullien, the appendages are not vibracular but avicularian, with a distinct bar and a prolonged mandible. The three supra-oral processes remind us of those of *Mamillopora crassilabris*, Kosch.

Héjjas has described as *Batopora aviculata*, H. ‡, a species with a large triangular avicularium, like those of *M. simplex*, K., below the oral aperture, but in the light of present investigations it is doubtful whether we must place it under *Batopora* or *Conescharellina*. He also makes a new genus *Batoporella* for a bilaminate form otherwise much like *Batopora*. Although he refers to the figure of it, there is none in my copy, and on the cover only two plates are referred to; evidently something has gone wrong about the plates, as the references do not correspond with the plates, and this is referred to as pl. v. fig. 13, though if it has been published it must have been on a plate vii.

Batopora multiradiata, Reuss.
(Pl. VI. figs. 4, 5, 6, 9, 10.)

Batopora multiradiata, Reuss, "Die foss. Anthoz. und Bry. der Schichtengruppe von Crosaro," Denk. math. naturwiss. Classe der k. Akad. der Wissenschaft. Wien, vol. xxix. pp. 265 & 292, pl. xxxi. figs. 1–4 (1869); Pergens, "Bry. foss. de Kolosvar," Bull. Soc. Roy. Malac. de Belgique, vol. xxii. p. 7 (1887); "Foss. Bry. von Wola Lu'zauska," Bull. Soc. Belge de Geol. vol. iii. p. 72 (1887); Waters, "North Italian Bryozoa," Quart. Journ. Geol. Soc. vol. xlvii. p. 32, figure in text (1891).

We have already learnt (p. 82) that the zoœcia, in mature zoaria, occur in two or more layers and the stage with only

* M. Faura & F. Canu, "Sur les Bry. des Terr. Tert. de la Catalogne," Inst. Catalana d'hist. natural. p. 100, fig. 12 (1918).

† "Drag. du Trav.," Bull. Soc. Zool. de Fr. vol. vii. p. 505, pl. xiii. figs. 13, 14 (1882); Calvet, Exp. Sc. du Trav. et Talisman, vol. vii. p. 441 (1907). Busk named a specimen of this species *Cellepora abyssicola* in MSS. from the Atlantic, 780–1095 fathoms ('Porcupine,' 99.7.1).

‡ Héjjas, Emerich, "Beit. z. Kennt. der Tertiären Bry. Siebenburgens," Sitz. Med. Naturwiss. Section des Siebenburgischen Museumsverein, vol. xvii. p. 214, pl. iv. fig. 11 (1894).

one layer has been called *Batopora stoliczkai*, Rss.*, and in very many localities both the first and mature stage have been found together. In sections, as in Pl. VI. fig. 4, the two layers are clearly seen, and also the interesting fact that the so-called "primordial Zelle" passes through the two layers. This has now to be called a pit, and is homologous with the pit in the *Sphærophora fossa* of Haswell. There are numerous tubes from the neighbouring zoœcia passing to the pit, and these were well seen during the preparation of the section ; also in *S. fossa* the large pores in the pit were seen to pass into minute chambers in the zoœcia (Pl. VI. figs. 2, 3).

Reuss considered that the colony grew from this pit, but he had missed some points of structure, though, from a manuscript left relating to *B. rosula* and which Manzoni † published, he clearly understood that there were two layers in a mature form. Koschinsky seems to have considered that the conical form grew first and then became globular, but this is reversing the process.

I think that one of the small zoœcia in the centre of the first stage is the primary, and also in *S. fossa* the primary was probably some distance from the pit. The base of the cone may also be covered by a secondary zoœcial growth. The base of the cone usually shows the one row of radiating zoœcia, but I have one specimen showing two rows (Pl. VI. fig. 5).

B. multiradiata is usually 2–3 mm. in diameter, sometimes showing the second layer as a cap (Pl. VI. fig. 4*a*); this outer layer is very irregular, being by no means always at the apex, in one the edge of the cap ends near to the pit. I have collected it mature from Brendola, Val di Lonte, Montecchio Maggiore, Priabona, Malo, Ferrara di Monte Baldo, Creazzo near Lonigo, Vilmezzano, Mazzurega, and the earlier or *stoliczkai* stage from Brendola, Val di Lonte, Montecchio Maggiore, Creazzo, Malo, Spiassi.

The base of the cone has the zoœcia arranged radially, just as in *Conescharellina*, and between the two genera there are only secondary differences on this surface, though in *Conescharellina* we are unaware of any case of the two layers, nor is there any pit, though there seem to be cases of

* Reuss was very near this idea, for, speaking of *B. multiradiata* from Val di Lonte, he says no other form is found and we cannot therefore hold it for a higher form of *Batopora*. Since then I have found many specimens of *B. stoliczkai* from Val di Lonte.

† "Bri. foss. del. Mioc. d'Aust. ed Ungh.," Denk. math. natw. Ak. der Wissensch. Wien, vol. xxxvii. p. 6, pl. ii. fig. 6 (1877).

several large pores probably serving the same purpose; but in spite of the very great similarity of form of growth *Conescharellina* has a much smaller oral aperture, with a trace of a sinus and muscular attachments some distance from the border, while *Batopora* has a nearly straight proximal edge with contractions at the side, as in most *Lepralia*, as the genus has been understood.

Orbitulipora and *Sphærophora*, both of which have a somewhat similar pit (large in *Sphærophora* and lateral in *Orbitulipora*), have much larger oral apertures than either *Batopora* or *Conescharellina*, and have a nearly straight proximal edge and large curved distal end, just as in *Holoporella*; further, *Conescharellina* has small cells with semilunar slits, whereas none are known in *Batopora*. *Conescharellina* has regular elongate chambers within the cone (Pl. VI. fig. 8), and these were clearly formed after the outer layer of zoœcia, whereas in *Batopora* the irregular chambers are zoœcial chambers formed before the outer barrel-shaped zoœcia.

The small *Cellepora globularis*, Reuss, from Val di Lonte, is readily mistaken for *Batopora multiradiata*, as small specimens are about the same size, though the zoœcia are larger and have two peristomial avicularia. This small globular form was evidently seen by Reuss* from Val di Lonte, but he and others have united under that name larger growths, without proof that they are the same species.

Also, *Conescharellina eocœna*, Neviani †, which occurs from several places in the Veneto, may at first glance seem to be *Batopora*, but examination of various characters and of the internal structure proves it to be *Conescharellina* (see Pl. VI. fig. 8).

Loc. Val di Lonte and Priabona (*Rss.*), Pap Patak; Pap Falvi Patak; Pap Falva, Kolos Monostor, Bács Szucsag, Wola Lu'zanska, and Ofener Mergel (Hungary (*Perg.*)), Eocene of Bavaria, and found by me from Val di Lonte, Brendola; Priabona; Montecchio Maggiore; Ferrara di Monte Baldo; Malo; Creazzo; between Sarego and Grotte near Lonigo (Vicentine); Mazzurega, near Fumane, Veronese (abundant in this locality); S. Urbano di Mt. Sgreve (Vicentine).

* Bry. Crosaro, p. 264 (52).

† This is the *Batopora conica*, Hantken, as proved from a specimen in the British Museum sent by Hantken, and this is interesting, for though Hantken often refers to it, yet it is not known whether he has described it. This species is dealt with in my other paper.

Mamillopora simplex (Koschinsky).

Stichoporina simplex, Koschinsky, "Bry. der ält. Tert. des Süd-Bayerns," Paleontographica, vol. xxxii. p. 64, pl. vi. figs. 4–7 (1885); Kirkpatrick, "Hyd. & Poly. Torres Straits," Proc. Roy. Dublin Soc. vol. vi. p. 623, pl. xvii. figs. 4 *a*, *b*, *c*, *d* (1890); Waters, "North Ital. Bry.," Quart. Journ. Geol. Soc. vol. xlvii. p. 31, pl. iv. figs. 16–18 (1891); de Angelis d'Ossat, ed. A. Neviani, "Corall. e Bri. Neog. di Sardegna," Bull. Soc. Geol. Ital. vol. xv. p. 16 (1897).

Mamillopora smitti, Calvet, Exp. Sc. du Trav. et du Talisman, Bry. vol. viii. p. 424, pl. xxvii. figs. 4, 5 (1907).

There are four species called *Stichoporina* in the North Italian Tertiary Beds, differing principally in the position and character of the avicularia. In *S. simplex*, K., there is on one side above the oral aperture a large triangular avicularium, though very occasionally one on both sides. Koschinsky thought that the avicularium was below the oral aperture, though his figure would suggest its being above, apparently he mistook the zoœcium to which it belonged. The second species, *S. protecta*, Kosch., has, as described by Koschinsky, a small round avicularium ("knopf-formiges—mit rundlicher Öffnung) at each side. This small avicularium, according to Canu *, may be pointed.

The third species (*Cupularia*) *bidentata*, Rss., has a small round avicularium at the distal end of the zoœcium, and the ovicell is very wide, wider than figured by Reuss. Canu also considers that what I determined as *S. simplex*, Kosch., is the *S. protecta*, K., but he seems to have overlooked the fact that Koschinsky mentioned and figured a large triangular avicularium at the side of the oral aperture in *S. simplex*. *S. crassilabris*, Kosch, from near Lonigo, Vicentine, has a projection above the oral aperture, often with a large central process or two lateral ones.

In neither of the four species mentioned have I seen a central pit, nor is one mentioned, while in (*Stichoporina*) *reussi*, Stol., which is the type, there is a distinct one, as figured by Stoliczka, and it is very marked in a specimen from Latdorf sent by Pergens. Other differences are mentioned on page 82.

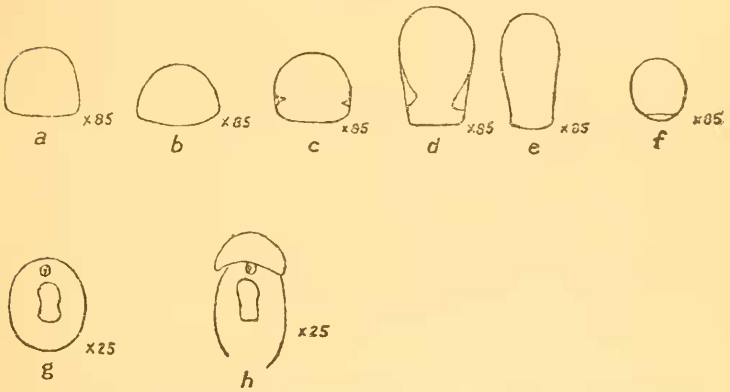
The oral aperture of *S. reussi* is much smaller (about 0·08 mm.) than that of the *M. bidentata* group, in which in the wider part the oral aperture, contracted at the side by a denticle, is about 0·12 mm. It is thus seen that the group just mentioned does not correspond with *S. reussi* and must be placed under *Mamillopora*, Smitt. Whether *S. reussi* should be placed with *Batopora* we may leave open.

* Bry. Terr. Tert. des Env. de Paris, p. 101 (1907).

Canu* united *Stichoporina reussi*, Stol., and *Batopora multiradiata*, Reuss, but it does not now seem that this can be maintained.

The North Italian specimens of *simplex* are 5·8 mm. diameter with the dome very little raised. Kirkpatrick's are 20 mm. and Calvet's have a more elevated cone, but I do not think that they should be separated on these grounds.

Fig. 1.



a. Oral aperture of *Sphærophora fossa*, Haswell. × 85.
b, *c*. Do. *Orbitulipora lenticularis*, Rss. × 85.
d, *e*. Do. *Mamillopora bidentata*, Rss. × 85.
f. Do. *Stichoporina reussi*, Stoliczka. × 85.
g. Zoœcium of *Stichoporina reussi*, Stoliczka. × 25.
h. Do. *Mamillopora bidentata*, Rss. × 25.

Loc. Götzreuth, Bavaria (*Kosch.*), and in my collection from Brendola; Priabona; Ferrara di Mt. Baldo; between Grotte and Sarego, near Lonigo; all in the Veneto: and living from Murray Island, Torres Strait (*Kirkp.*); also Cape of Good Hope and Malacca (*K.*); Saint Vincent, Cape Verde Islands, 21 met. (*Calvet*).

Mamillopora bidentata (Reuss).
(Pl. VI. figs. 7, 11; text-fig. 1, *d*, *e*, *h*.)

Cupularia bidentata, Reuss, "Pal. Stud. über die älteren Tert. der Alpen," Denk. Akad. Wiss. Wien, vol. xxix. p. 277, pl. xxix. figs. 1, 2 (1869); Pergens, Bry. Foss. des Env. de Kolosvar, p. 7 (only in list) (1887).

* Bry. Tert. Ann. de Paleont. vols. ii.–iv. p. 100, pl. xi. figs. 16, 17, 18.

Reuss's figure was difficult to understand, but there is no doubt that specimens in my collection are this species, and also on further cleaning up the specimen from Pap Falvi Patak sent by Pergens the characters can be made out. The zoœcia are raised, the oral aperture is straight below and is contracted at each side, so that of course the aperture was filled by the operculum, whereas in *Cupularia* the opening is opesial. At the distal end of the zoœcium there is an appendage, but whether avicularian or vibracular it is difficult to say, though probably avicularian. The opening to this appendage is apparently round, but details cannot be deciphered.

There is no pit and the primary is a small zoœcium surrounded by six zoœcia (Pl. VI. fig. 7).

The ovicell is very wide and raised, similar to what I figured * in *Fedora excelsa*, Kosch., and is placed beyond the avicularium—a position so far from the oral aperture is difficult to explain.

Loc. Val di Lonte and Grancella (*Rss*.), Eocene of Hungary); Pap Patak; Pap Falvi Patak; Marne de Buda (*Pergens*), Bocca di Sciesa, Colle Berici, and Malo, Vicentine (*A. W. coll.*).

Mamillopora crassilabris (Koschinsky).

Stichoporina crassilabris, Koschinsky, Bry. Süd-Bay. p. 66, pl. vii. figs. 1–4 (1855).

A specimen of *Mamillopora* from between Grotte and Sarego, near Lonigo, Vicentine, has a great thickening above the oral aperture, sometimes rising in one or three processes, the middle one of which is an avicularium or vibraculum, and it looks like the appendage of *M. bidentata* very much enlarged and erect. No other appendage is visible, but the state of the fossil in not satisfactory. A small specimen of *M. simplex* † from Brendola has a thickening above the oral aperture, also a large triangular avicularium by the side. There are six zoœcia round the primary and further cleaning recently has enabled better study. May not this thickening occur in various species of the group under certain conditions?

Loc. Götzreuth (*K.*), between Grotte and Sarego.

* "N. Ital. Bry.," Quart. Journ. Geol. Soc. vol. xlvii. p. 29. pl. iv. fig. 6 (1891).

† *Loc. cit.* fig. 18.

Sphærophora fossa, Haswell.
(Pl. VI. figs. 1–3; text-fig. 2, *a*.)

Sphærophora fossa, Haswell, "Poly. from Queensland Coast," Proc. Linn. Soc. N.S. Wales, vol. v. p. 42, pl. iii. figs. 5, 6 (1880); "Note on a Curious Instance of Symbiosis," *op. cit.* vol. vii. p. 608 (1882).

Cellepora fossa, Waters, "Foss. Cheil. Bry. S.W. Australia," Quart. Journ. Geol. Soc. vol. xxxvii. p. 343, pl. xviii. fig. 89 (1881); *op. cit.* vol. xxxviii. p. 275 (1882); *op. cit.* vol. xxxix. p. 426 (1883); *op. cit.* vol. xli. p. 307, fig. 2 (1885); MacGillivray, "Tert. Poly. of Victoria," Trans. R. Soc. Vict. vol. iv. p. 108, figs. 8, 9, 10 (1895); Maplestone, "Tab. List Cheil. Poly. in Vict. Tert.," Proc. R. Soc. Vict. vol. xvii. n. s. p. 215 (1904); "New or Little-known Poly.," Proc. R. S. Vict. n. s. vol. xxv. p. 361 (1913).

? *Cellepora tubulosa*, Busk.

On re-examination of the fossil specimen from Curdies Creek, I find that the growth commences on the part opposite to the pit, it then grows over to the underside, in which the pit is situated, a mode of growth which we have seen occurs in Reuss's *Diplotaxis*, so that when we are looking at the pit it is at the completion not the beginning of the zoarium. A similar pit, though much smaller, has been described as the "primordial Zelle" in *Batopora* and other genera (see page 80).

Haswell described the zoarium as subspherical, slightly depressed, with a circular pit at the upper pole, a description quite describing specimens from Queensland, which he kindly sent to me, as one side is somewhat flattened and the pit is at the opposite pole; but in some fossils * from Batesford or Muddy Creek the surface with the pit is the flatter, showing the zoœcia directed to the pit (Pl. VI. fig. 1), and these are the best preserved of any specimens, recent or fossil, examined by me. In these the pit is 0·55 mm. in diameter, and from Percy Island the six specimens have pits 0·8 mm., 0·6 mm., 0·55 mm. In *Batopora multiradiata*, Rss., the pits are much smaller, being 0·25–0·27 mm. from Ferrara di Monte Baldo, Brendola, Montecchio Maggiore, and Val di Lonte; a pit in *Orbitulipora petiolus* measures 0·36 mm.

Batopora was described as with a single "aufrecht stehende Zelle." This so-called "primordial Zelle" also in *Sphærophora* stands out surrounded by a border, and is much larger than any of the zoœcial openings, but we must now call it a pit and this is referred to on page 80. This reversal of the position of the zoœcia, though not quite the same as now known in *Conescharellina*, yet reminds us of that genus.

* "Foss. Chil. Bry. from Muddy Creek," Quart. Journ. Geol. Soc. vol. xxxix. p. 426 (1883).

It seems as though both in *Sphærophora* and *Batopora* the zoœcia have grown over the primary in all directions, and this we see in *Orbitulipora excentrica,* Seg. (see page 92), and in *O. petiolus.*

The ovicell of *Sphærophora* is large, round, raised, and open in front.

Referring to the two specimens from Batesford or Muddy Creek, it is well to recall the fact that Haswell mentions a form with a flat base without giving it a name. The fossil *Cellepora serrata*, MacG., also has a flat base and clearly belongs to *Sphærophora.*

Loc. Holborn Island, Queensland (*H.*); Percy Island, Queensland, 11 fath., sent by Haswell; N.E. coast of Australia, sent by Brazier; South Australia (*Maplestone*).

Fossil. Curdies Creek, S.W. Victoria; Mt. Gambier; Aldinga and River Murray Cliff (*all A. W. W.*), Schnapper Point, Bird Rock, Corio Bay, Waurn Ponds (*all MacG.*), Cape Otway, Spring Creek, Muddy Creek, Shelford, Fyansford, Mornington, Mitchell River (*Maplestone*).

Orbitulipora excentrica, Seguenza. (Text-figs. 2, *a*, *b*, *c*.)

Orbitulipora excentrica, Seguenza, "Le Formaz. Terz.," Atti Reale Accad. dei Lincei, ser. 3, vol. vi. p. 130, pl. xii. figs. 22, 22 *a* (1879); Neviani, "Bri. neog. delle Calabrie," Pal. Ital. vol. vi. p. 188, pl. xvii. figs. 15, 16 (1900).

Orbitulipora excentrica, var. *flabellata*, D'Ossat & Neviani, "Coral. e Bri. Neog. di Sardegna," Boll. Soc. Geol. Ital. vol. xv. p. 18 (1897).

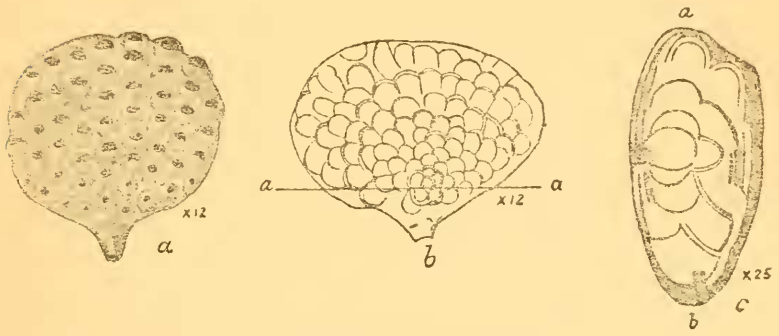
I had written a description of specimens from Mazzurega as *O. excentrica*, nov., before remembering that Seguenza had described a species with this specific name, which, although larger and with more zoœcia than the Mazzurega fossils, is apparently the same species. Mine are about the same size as Neviani's var. *flabellata.* There are several specimens from material collected from Mazzurega, near Fumane in the Veronese, N. Italy, sent to me by Professor Parona. The age was considered Bartonian, but is now called Priabonian. The bilaminate depressed zoaria are small, about 2–3 mm. in diameter, with a stalk (as it has been called in *O. petiolus*), from which the zoœcia spread out in fan-shaped form, more or less in rows. The stalk or pedicle is for attachment, as is the case with the pits of *Batoporæ* and *Orbituliporæ,* and it sometimes gives a subtriangular appearance to the zoarium.

The zoœcia are very distinct and rounded, as seen from above, and in the younger ones the aperture occurs about the centre of the apparently nearly round erect zoœcia,

while in the larger older zoœcia the aperture has a nearly straight proximal border, below which there is sometimes a large avicularian chamber. It is, however, as a rule, very difficult to see the shape of the oral aperture, so that, although outlined by the camera lucida, the restoration of some of the apertures has been necessary.

This is very closely allied to *O. petiolus*, Lonsdale *, and he, Stoliczka †, Reuss ‡, Vine §, and Gregory ‖, all show the central zoœcia the smaller, and speak of the zoœcia radiating from the centre of the zoarium; also the text and figures indicate that it is depressed, which is not the case in the North Italian fossils, nor is it always so in the specimens of *petiolus* which I have examined. Various authors have referred to an ovicell in *O. petiolus*, but it is spoken of as

Fig. 2.



Orbitulipora excentrica, Seg.

a. × 12. *b*. Longitudinal section. × 12.
c. Transverse section near base. × 25.

proximal to the oral aperture, whereas it is distal and directed towards the centre of the disk. In my specimens of *excentrica* no ovicells are distinguished, though some zoœcia have a large suboral avicularium.

Horizontal sections of *excentrica* are extremely interesting, as they show the primary very near to the stalk, referred to as the pit in *Sphærophora*, *Batopora*, and *Stichoporina*. The

* Dixon's 'Geology of Sussex,' p. 151, pl. i. fig. 10 (1850).
† Olig. Bry. von Latdorf, p. 91, pl. iii. fig. 5 (1861).
‡ Bry. d. deutschen Unterolig. p. 217, pl. i. figs. 1, 2 (1867).
§ Vine, "Notes on Brit. Eoc. Poly.," Proc. York. Geol. Polytech. Soc. vol. xi. p. 164, pl. v. fig. 10 (1889).
‖ "On the Brit. Palæog. Bry.," Trans. Zool. Soc. Lond. vol. xiii. pt. vi. p. 253, pl. xxxi. fig. 12 (1893).

round primary is surrounded by five zoœcia, and then from these the ordinary zoœcia grow, so that there are zoœcia all round the primary, and I have already suggested that the first zoœcium of *Batopora* was not very far from the pit, formerly mistaken for a "primordial cell." The section, text-fig. 2, *c*, was made to show the central zoœcia at right angles to text-fig. 2, *b*, and the relationship of the zoœcia on each side. Text-fig. 2, *c*, is magnified about twice as much as text-fig. 2, *b*, and is from about the line *a*–*a*, text-fig. 2, *a*. A series of transverse sections are required to completely understand the growth, but this is not possible.

There is in *O. petiolus* a pit to the younger zoaria, and as growth proceeds this is prolonged, so that in mature zoaria there is a tunnel from the centre to the large external pit, and this can in places be seen through the layers of zoœcia covering it. Sections show this tube more clearly from the centre to the projection, and inside this tube fairly large pores occur in regular lines.

Some of the specimens in the British Museum, marked *Heteropora glandiformis*, Gregory*, are young *O. petiolus*, and in one case a pit can be seen. Besides this there are one or two which, though worn, show signs of a base like that of *Conescharellina cancellata*, Busk (figure 22 in a paper now ready). The specimens, being mounted, could consequently not be examined all round, but in none was I able to distinguish Cyclostomatous characters.

Reuss thought that the process of *petiolus*, subsequently called stalk, pedicle, or pit, had no connection with the structure of the zoarium, and was only accidental, but we now see that it is the prolongation of the pit.

O. petiolus, Lonsd., occurs from beds of about the same age as the Mazzurega deposit, having been found by Dixon from Bracklesham, by Stoliczka from Latdorf, by Reuss from the Lower Oligocene of Calbe and Bünde; Vine says from Barton Bay; Brackelsham; Stubbington; Gregory besides these mentions Bramshaw and Brook; Vincent and Th. Lefèvre† say it occurs in Belgium from the Bruxellian, Laekenien (Upper Eocene), Wemmelien and Tongrian (Oligocene), subsequently also referred to by Mourlon; Canu mentions it from the Bartonian of Var in the Paris basin.

Loc. of *excentrica*. Tortonian (*Seg.*), Mioc. of Calabria

* "British Palæogene Bryozoa," Trans. Zool. Soc. vol. xiii. p. 261, pl. xxxii. fig. 11 (1893).

† "Faune Laek. sup. des Environs de Bruxelles," Ann. Soc. Malac. de Belge, vol. vii. p. 29 (1872).

and of Cadreas sopra Bonurra, Sardinia (*Nev.*); Mazurrega, Veronese (*A. W. coll.*).

The forms dealt with may be provisionally placed as follows. It is a group with erect, usually barrel-shaped zoœcia :—

I. With a pit towards which the zoœcia are directed.

1867. Batopora, Rss.—Oral aperture small (0·09 mm.), nearly round, but examination shows straight lower edge. Bi-laminate. Primary zoœcia hidden. Type, *B. stoliczkai*, Rss. (probably young of *B. multiradiata*, Rss.).

1861. Orbitulipora, Stoliczka.—Oral aperture large, with straight lower edge. Pit at the side. Bi-multilayered. Type, *O. haidingeri*, Stol.

1881. Sphærophora, Haswell.—Oral aperture large (0·12 mm.), with straight lower edge. Grows in all directions from the early zoœcia. Pit central. Multi-laminate. Type, *S. fossa*, Haswell.

1852. Stichoporina, Stoliczka.—Oral aperture small. Uni-laminate to bi-laminate? Pit central. Type, *S. reussi*, Stol.

II. Usually without a pit.

1873. Mamillopora, Smitt*.—Oral aperture large (0·12 mm.), contracted at each side. Primary zoœcium erect, surrounded by six similar zoœcia. Only uni-laminate, showing the position of the zoœcia on the under surface. Type, *M. cupola*, Sm. Tertiary fossils: *M. simplex*, Kosch., *M. bidentata*, Rss., *M. protecta*, Kosch.

1851. Conescharellina, d'Orb.—Oral aperture very small, slight sinus, opercula with muscles some little distance from the border, semilunar slits. Cone uni-laminar, filled in by large chambers. (To be dealt with in the larger paper.) Type, *C. angustata*, d'Orb. (A species fossil from N. Italy has large pores round the apex, and one near the centre is larger and might be called a pit.)

EXPLANATION OF PLATE VI.

Fig. 1. *Sphærophora fossa*, Haswell, × 10. Surface with a large pit. The zoœcia are shown directed towards the pit. From Batesford or Muddy Creek, fossil.

Fig. 2. Ditto. × 10. Section showing the pit. From Percy Island, recent.

Fig. 3. Ditto. × 25. Section of the pit, showing the pores leading to the zoœcia. From Percy Island.

Fig. 4. *Batopora multiradiata*, Reuss., × 25. Section showing the pit and the zoœcia in a second layer round the first. From near Novezzina, fossil. (*a*) × 2. Zoarium showing a cap formed by a second layer of zoœcia. From Montecchio Maggiore.

Fig. 5. Ditto. × about 10. Base showing two circles of zoœcia. This is the only specimen showing two basal circles clearly.

Fig. 6. Ditto. × 25. Showing the pit with smaller zoœcia round it, as well as the ordinary zoœcia. From Val di Lonte.

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* I have published a figure of the operculum of *Fedora edwardsii*, Jull., in "North Ital. Bry.," Quart. Journ. Geol. Soc. vol. xlvii. pl. iv. fig. 7; and Kirkpatrick has published one of *M. simplex*, Kosch. Proc. R. Dublin Soc. n. s. vol. vi. pl. xvii. fig. 4 (1890).

Fig. 7. *Mamillopora bidentata*, Reuss, × 25. Showing the primary zoœcium and the six surrounding zoœcia. From Bocca di Sciesa.

Fig. 8. *Conescharellina eocœna*, Neviani, × 10. Section from Spiassi, N. Italy.

Fig. 9. *Batopora multiradiata*, Rss., × 25. Showing ovicells. From Montecchio Maggiore.

Fig. 10. Ditto. × 10. Showing the formation of a second layer from the neighbourhood of the pit. From Val di Lonte.

Fig. 11. *Mamillopora bidentata*, Reuss, × 25. Showing ovicell. From Bocca di Sciesa. (*a*) zoarium, × 3.

Fig. 12. *Conescharellina eocœna*, Neviani, × 25. This figure is built up from various parts, as the preservation as a whole is not perfect. From Spiassi.

VIII.—*Two new African Freshwater Sponges*. By Jane Stephens, B.A., B.Sc., National Museum of Ireland.

Several years ago Dr. Annandale (5) drew attention to the somewhat oyster-like shells of the genus *Ætheria* as affording a favourable starting-place for the growth of freshwater sponges, not only on account of their roughened and often corrugated surface, but also owing to the fact that, like true oysters, their lower valve is firmly fixed to some solid support. Dr. Annandale stated that at least one species of freshwater sponge, *Corvospongilla loricata* (Weltner), had already been described from an *Ætheria* shell, when an examination of the shells belonging to this genus in the collections of the Indian Museum led him to the discovery of two new species of sponges. He remarked that he had little doubt that other sponges would be brought to light if the *Ætheria* shells preserved in museums were carefully scrutinized. Following Dr. Annandale's suggestion, the *Ætheria* shells in the collection of this museum were examined, with the result that two well-marked new species were discovered on one shell, and a few broken gemmules, too fragmentary to identify, on another.

As is well known, the genus *Ætheria* occurs only in Africa and in the north-west part of Madagascar. On the continent of Africa it is confined to the tropics, except that it descends the River Nile to the mouth. Many species have been described from time to time, but the researches of Drs. Anthony and Germain (6, p. 372) have shown that there is only one species—a very polymorphic one, namely *Ætheria elliptica*, Lamarck. Two varieties are, however, recognized by these authors—*Æ. elliptica*, var. *typica*, Germain, a smooth